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(11)

EP 0 824 074 A2

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:  
18.02.1998 Bulletin 1998/08

(51) Int Cl.<sup>6</sup>: B41J 25/34

(21) Application number: 97306149.2

(22) Date of filing: 13.08.1997

(84) Designated Contracting States:  
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC  
NL PT SE

(30) Priority: 14.08.1996 JP 233589/96  
17.07.1997 JP 208695/97

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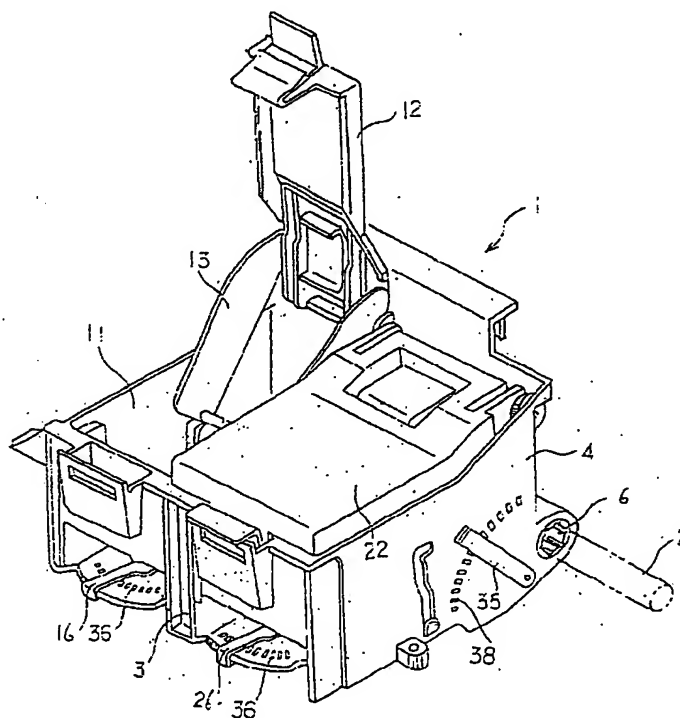
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## (54) Recording head position adjusting mechanism in ink jet recording apparatus

(57) Not only two plates mounted so as to be displaceable in a scanning direction as well as in a sheet forward direction with reference pins as pivots can be adjusted independently by angle adjusting levers that can be operated by turning, but also a color recording

head can be adjusted in the sheet forward direction by a nozzle position adjusting lever with a black recording head as a reference, the nozzle position adjusting lever being disposed on a side wall of a carriage so as to be operable by turning.

FIGURE 1



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## Description

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The invention relates to a recording head position adjusting mechanism in an ink jet recording apparatus.

#### 2. Description of the Related Art

If a black recording head and a color recording head are mounted on a single carriage in order to compose a color printer using a serial type on-demand ink jet recording apparatus, the mechanical tolerances and mounting tolerances inherent in the respective recording heads cause relative positioning errors, and these errors cannot form a satisfactory color images.

To overcome this problem, a mechanism disclosed in Japanese Patent Publication No. Hei. 7-314851 was considered. This mechanism not only corrects an inclination of each recording head independently by interposing a rotary correcting plate in either one of scanning directions on a contact surface extending in parallel to the scanning directions, but also adjusts a sheet forward direction in one of the recording head based upon the other recording head by interposing an adjusting plate on either one of positioning surfaces extending in parallel to the scanning directions.

This mechanism provides the advantage that the inclination adjustment as well as the position adjustment in the sheet forward direction of the recording heads can be made simultaneously. However, these adjustments not only require that a plurality of rotary correcting plates and adjusting plates whose thicknesses are different according to amounts of correction, but also are likely to cause slight recording head positioning errors during the process of inserting such correcting plates and adjusting plates, which has called for further improvement.

### SUMMARY OF THE INVENTION

The invention has been made in view of such problems. An object of the invention is, therefore, to provide a novel recording head position adjusting mechanism capable of correctly adjusting the inclination of a recording head by simply turning a lever disposed on a carriage.

Further, another object of the invention is to provide a novel recording head position adjusting mechanism capable of adjusting the position of one of the recording heads in a sheet forward direction relative to the other recording head by simply a lever disposed on the carriage.

According to a first aspect of the invention, there is provided a recording head position adjusting mechanism in an ink jet recording apparatus, wherein a carrying body carrying a recording head is arranged to be

pivotable by a reference pin as a fulcrum on the carriage in a scanning direction; and an angle adjusting member arranged on the carriage at a distant position from the pin, the angle adjusting member having a cam surface which displaces the carrying body in the scanning direction by coming in contact with the carrying body.

According to a second aspect of the invention, there is provided a recording head position adjusting mechanism in an ink jet recording apparatus, wherein two carrying bodies each carrying a recording head are arranged on a carriage, and one carrying body is displaced in a sheet forward direction with respect to the other carrying body, comprising: a nozzle position adjusting member arranged on the carriage, which is displaced one of the two carrying bodies in a sheet forward direction by coming in contact with the one of the two carrying bodies.

According to a third aspect of the invention, there is provided a recording head position adjusting mechanism in an ink jet recording apparatus, wherein two carrying bodies each carrying a recording head are arranged on a carriage, comprising: two pins arranged on the carriage, which are pivotable and slidable on the pins; two angle adjusting members arranged on the carriage, have a cam surface for displacing the carrying body in a scanning direction by coming in contact with the carrying body; and a nozzle position adjusting member arranged on the carriage, the nozzle position adjusting member displacing one of the two carrying bodies in a sheet forward direction by coming in contact with the one of the two carrying bodies.

### BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a perspective view of an apparatus, which is an embodiment of the invention;

Fig. 2 is a diagram showing the apparatus from above;

Fig. 3 is a diagram showing the apparatus from a side; and

Fig. 4 is a diagram illustrative of adjusting conditions.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the invention will now be described below.

The respective drawings show the embodiment of the invention applied to a color ink jet recording apparatus that has made only ink cartridges to be replaceable.

The general construction of this embodiment will be described first with reference to Fig. 1.

In Fig. 1, reference numeral 1 denotes a carriage main body that shuttles along a guide rod 2 in a main

scanning direction. Two cartridge accommodating chambers 11, 21 that respectively accommodate a black ink cartridge 10 and a color ink cartridge 20 are formed in the carriage main body 1 through a partition wall 3. The cartridge accommodating chambers 11, 21 have lifters 13, 23 for taking out vacant ink cartridges 10, 20 and coupling new ink cartridges 10, 20 to recording heads 19, 29 by interlocking with the opening and closing of covers 12, 22.

Two angle adjusting levers 16, 26 that serve to adjust the inclinations of the recording heads 19, 29 independently are disposed at portions corresponding to the cartridge accommodating chambers 11, 21 on a board 5 of the carriage main body 1. The two angle adjusting levers 16, 26 will be described later in detail. These angle adjusting levers 16, 26 are turnably arranged so that the levers can be operated from the front of the carriage main body 1. Further, a nozzle position adjusting lever 35 that allows the position of only the color recording head 29 to be adjusted in a sheet forward direction based upon the position of the black recording head 19 is turnably disposed on a side wall 4 on the side of the cartridge accommodating chamber 21 that accommodates the color ink cartridge 20. Reference numeral 6 denotes a sleeve having oil grooves, which slides on the guide rod 2.

These respective position adjusting mechanisms are the features of the invention. The construction of these position adjusting mechanisms will hereunder be described in more detail with reference to Figs. 2 and 3.

Fig. 2 is a diagram showing the carriage main body 1 from above with the covers 12, 22 removed. Reference pins 14, 24 are integrally formed at a portion of the board 5 of the carriage main body 1 closer to the guide rod 2 and in the middle of the respective accommodating chambers 11, 21 so as to project therefrom. Plates 15, 25 that serve as carrying bodies respectively carrying the recording heads 19, 29 are set into these reference pins 14, 24 so as to be pivotable and slidable through positioning slits 15a, 25a. Further, a projected portion 9 is arranged at a portion of the board 5 closer to the guide rod 2 on the side of the black ink cartridge accommodating chamber 11 which is positioned in a Y-axis direction, i.e., the sheet forward direction by contacting with the plate 15.

On the other hand, these plates 15, 25 are mounted on the board 5 so as to be slightly displaced by mounting machine screws 15b, 25b that are arranged on the opposite side of the positioning slits 15a, 25a. Further, contact surfaces 15c, 25c that come in contact with cam surfaces 16a, 26a of the angle adjusting levers 16, 26 to be described later in detail are arranged on the opposite side of these positioning slits 15a, 25a. These contact surfaces 15c, 25c are arranged orthogonally to the guide rod 2. Further, on one side of these contact surfaces 15c, 25c, spring receiving seats 15d, 25d which receive urging forces of springs 17, 27 in an X-axis direction (main scanning direction) and in the Y-axis di-

rection are arranged at an angle of about 45°.

The plate 15 that carries the black recording head 19 is urged toward the reference pin 14 and the cam surface 16a of the angle adjusting lever 16 in the X-axis direction and toward the projected portion 9 on the board 5 in the Y-axis direction, respectively, by the spring 17 that is interposed between the spring receiving seat 15d and the board 5. On the other hand, the plate 25 that carries the color recording head 29 is urged toward the reference pin 24 and the cam surface 26a of the angle adjusting lever 26 in the X-axis direction and toward an eccentric portion 35a of the nozzle position adjusting lever 35 in the Y-axis direction, respectively, by the spring 27 that is interposed between the spring receiving seat 25d and the board 5. The nozzle position adjusting lever 35 will be described later in detail.

The levers 16, 26 that adjust the angles of the plate 15, 25 are pivotally mounted so as to be turnable on pivot pins 16b, 26b that are protruded as pivots on the board 5 close to the contact surfaces 15c, 25c of the plates 15, 25, so that the plates 15, 25 are adjusted to turn around the reference pins 14, 24 by contacting the cam surfaces that are the front ends of the lever 16, 26 with the contact surfaces 15c, 25c of the plates 15, 25. Reference numerals 36, 36 denote click holes that are arcuately arranged at corresponding positions on the board 5 so that the angle adjusting levers 16, 26 can be positioned according to graduations, and reference numerals 37 denote pressing pieces formed on the board 5 so that the cam surfaces 16a, 26a of these levers 16, 26 are pressed onto the contact surfaces 15c, 25c of the plates 15, 25.

On the other hand, the nozzle position adjusting lever 35 is turnably disposed at a lower portion of the side wall 4 of the carriage main body 1 on the side of the color ink cartridge accommodating chamber 21.

As shown in Fig. 2, the disk 35a whose outer circumference serves as a cam surface is eccentrically attached to part of a support shaft 35b of this adjusting lever 35. The front end of the plate 25 that carries the color recording head 29 is brought into contact with the disk 35a at all times by a component force of the spring 27 applied in the Y-axis, so that the plate 25 can be displaced in a direction orthogonal to the axis of the guide rod 2, i.e., in the Y-axis direction through the disk 35a by turning the nozzle position adjusting lever 35. Reference numeral 38 in Figs. 1 and 2 denotes click holes formed as an arc-shaped in the side wall 4 so that the nozzle position adjusting lever 35 can be positioned according to graduations.

In such constructed embodiment, the plates 15, 25 that carry the black and color recording heads 19, 29 are respectively positioned and fixed on the board 5 of the carriage main body 1 with the left side surfaces of the positioning slits 15a, 25a and the contact cam surfaces 15c, 25c brought into contact with the reference pins 14, 24 and the cam surfaces 16a, 26a of the angle adjusting levers 16, 26 in the X-axis direction, respec-

tively, and with the plate 15 that carries the black recording head 19 brought into contact with the projected portion 9 on the board 5 and with the front end of the plate 25 that carries the color recording head 29 brought into contact with the disk 35a of the nozzle position adjusting lever 35 in the Y-axis direction by the urging forces of the springs 17, 27 that act on the surfaces of the spring receiving seats 15d, 25d being arranged at an angle of about 45°.

If the inclination of a nozzle array 29a arranged, e.g., on the color recording head 29 must be adjusted under this condition, the corresponding angle adjusting lever 26 is operated by turning in an adjusting direction, e.g., counterclockwise (as viewed in Fig. 4) by an amount required for adjustment.

As a result of this operation, the plate 25 is displaced by turning in the direction indicated by the arrow in Fig. 4 with the reference pin 24 as a pivot through the contact surface 25c that comes in contact with the cam surface 26a while holding the color recording head 29 carried by the plate 25. That is, the nozzle array 29a arranged on the color recording head 29 is adjusted by turning by an angle  $\theta$ .

When the nozzle position adjusting lever 35 disposed on the side wall 4 on the side of the color ink cartridge accommodating chamber 21 is operated by turning in an adjusting direction by a required amount so that the positions of the openings of black and color nozzles 19a, 29a coincide with one another in the sheet forward direction under the thus adjusted condition, the plate 25 which carries the color recording head 29 and whose front end is brought into contact with the disk 35a of the lever 35 is displaced in a direction orthogonal to the axis of the guide rod 2, i.e., in the Y-axis direction while guided by the reference pin 24 and the cam surface 26a of the angle adjusting lever 26. Then, the black nozzle openings are positioned based upon the color nozzle openings so as to coincide with one another correctly in the sheet forward direction with the black recording head 19 as a reference.

As described in the foregoing, according to the invention, not only recording head carrying bodies serving as non-adjusted members are attached so as to be displaceable by turning in a scanning direction with reference pins arranged on a carriage as pivots, but also angle adjusting members for adjusting the angles of these carrying bodies are mounted on the carriage so as to be operable by turning. Therefore, not only the positioning of the adjusted members relative to the non-adjusting members can be implemented through the common carriage, but also the angle adjusting member on the carriage adjust the angles of the non-adjusting member and can make adjustment of this type remarkably correct and simple.

Further, one of two carrying bodies is adjusted in the sheet forward direction by a nozzle position adjusting member that is mounted on the carriage so as to be operable by turning. Therefore, extremely subtle posi-

tion adjustment of the type, such as the nozzle position adjustment between the recording heads can be made simply and correctly not only by the nozzle position adjusting member on the carriage on which the carrying bodies are mounted but also by making one of the recording head carrying bodies as a reference.

## Claims

1. A recording head position adjusting mechanism in an ink jet recording apparatus, wherein a carrying body carrying a recording head is arranged on a carriage, comprising:

a pin arranged on said carriage, said carrying body being pivotable about said pin in a scanning direction; and

an angle adjusting member arranged on said carriage at a distant position from said pin, said angle adjusting member having a cam surface which serves to displace said carrying body in the scanning direction while coming in contact with said carrying body.

2. The recording head position adjusting mechanism according to claim 1, further comprising a spring member being arranged on said carriage, said spring member acting on said carrying body obliquely so as to urge said carrying body in the scanning direction and in a sheet forward direction.
3. The recording head position adjusting mechanism according to claim 1, wherein a slit is formed in said carrying body, and said pin is positioned in said slit.
4. The recording head position adjusting mechanism according to claim 1, wherein said angle adjusting member is operable by turning so as to displace said carrying body.
5. The recording head position adjusting mechanism according to claim 4, wherein click holes are provided in said carriage, so that said angle adjusting member is positioned according to graduations.
6. The recording head position adjusting mechanism according to claim 4, further comprising a pressing piece arranged in said carriage so as to press said angle adjusting member onto said carrying body.
7. A recording head position adjusting mechanism in an ink jet recording apparatus, wherein two carrying bodies each carrying a recording head are arranged on a carriage, and one carrying body is displaced in a sheet forward direction based upon the other carrying body, comprising:
  - a nozzle position adjusting member arranged

on said carriage, said nozzle position adjusting member displacing one of said two carrying bodies in a sheet forward direction by coming in contact with the one of said two carrying bodies.

8. The recording head position adjusting mechanism according to claim 7, wherein said nozzle position adjusting member includes a support shaft being disposed parallel to a scanning direction, and a disk essentially attached to said support shaft and having a cam surface which comes in contact with one of said two carrying bodies.

9. The recording head position adjusting mechanism according to claim 7, wherein said nozzle position adjusting member is operable by turning so as to displace one of said carrying body.

10. The recording head position adjusting mechanism according to claim 9, wherein click holes are provided in said carriage, so that said nozzle position adjusting member is positioned according to graduations.

11. A recording head position adjusting mechanism in an ink jet recording apparatus, wherein two carrying bodies each carrying a recording head are arranged on a carriage, comprising:

two pins arranged on said carriage, said two carrying bodies being pivotable and slidable about said pins;

two angle adjusting members arranged on said carriage, said angle adjusting member having a cam surface which serves to displace said carrying body in a scanning direction by coming in contact with said carrying body; and  
a nozzle position adjusting member arranged on said carriage, said nozzle position adjusting member displacing one of said two carrying bodies in a sheet forward direction by coming in contact with the one of said two carrying bodies.

12. The recording head position adjusting mechanism according to claim 11, further comprising a spring member being arranged on said carriage, said spring member acting on said carrying body obliquely so as to urge said carrying body in the scanning direction and in the sheet forward direction.

13. The recording head position adjusting mechanism according to claim 11, wherein a slit is formed in said carrying body, and said pin is positioned in said slit.

14. The recording head position adjusting mechanism according to claim 11, wherein said angle adjusting members and nozzle position adjusting members

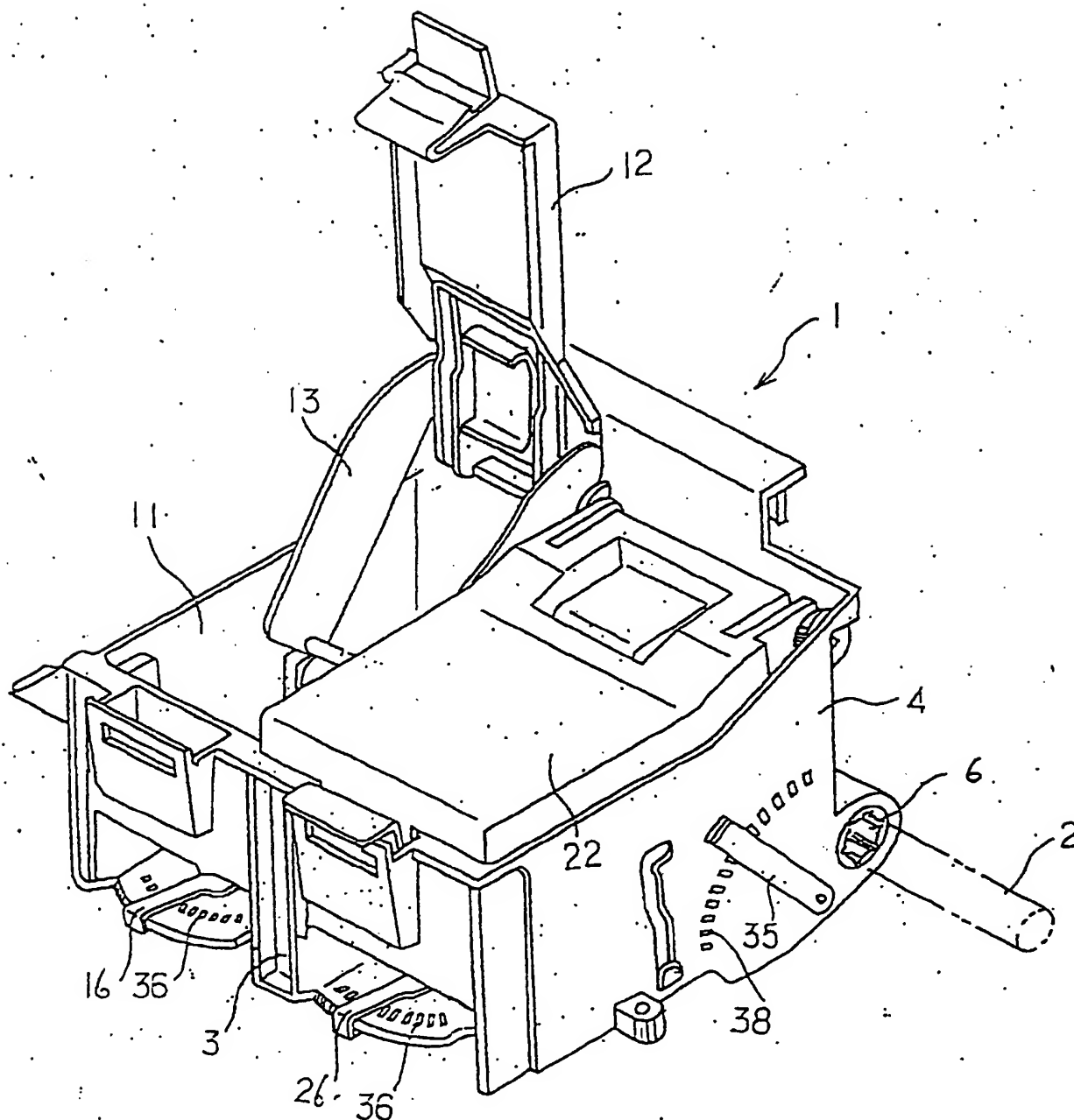
are operable by turning so as to displace said carrying bodies.

15. The recording head position adjusting mechanism according to claim 14, wherein click holes are provided in said carriage, so that said angle adjusting members and nozzle position adjusting members are positioned according to graduations.

16. The recording head position adjusting mechanism according to claim 11, further comprising a pressing piece arranged in said carriage so as to press said angle adjusting member onto said carrying body.

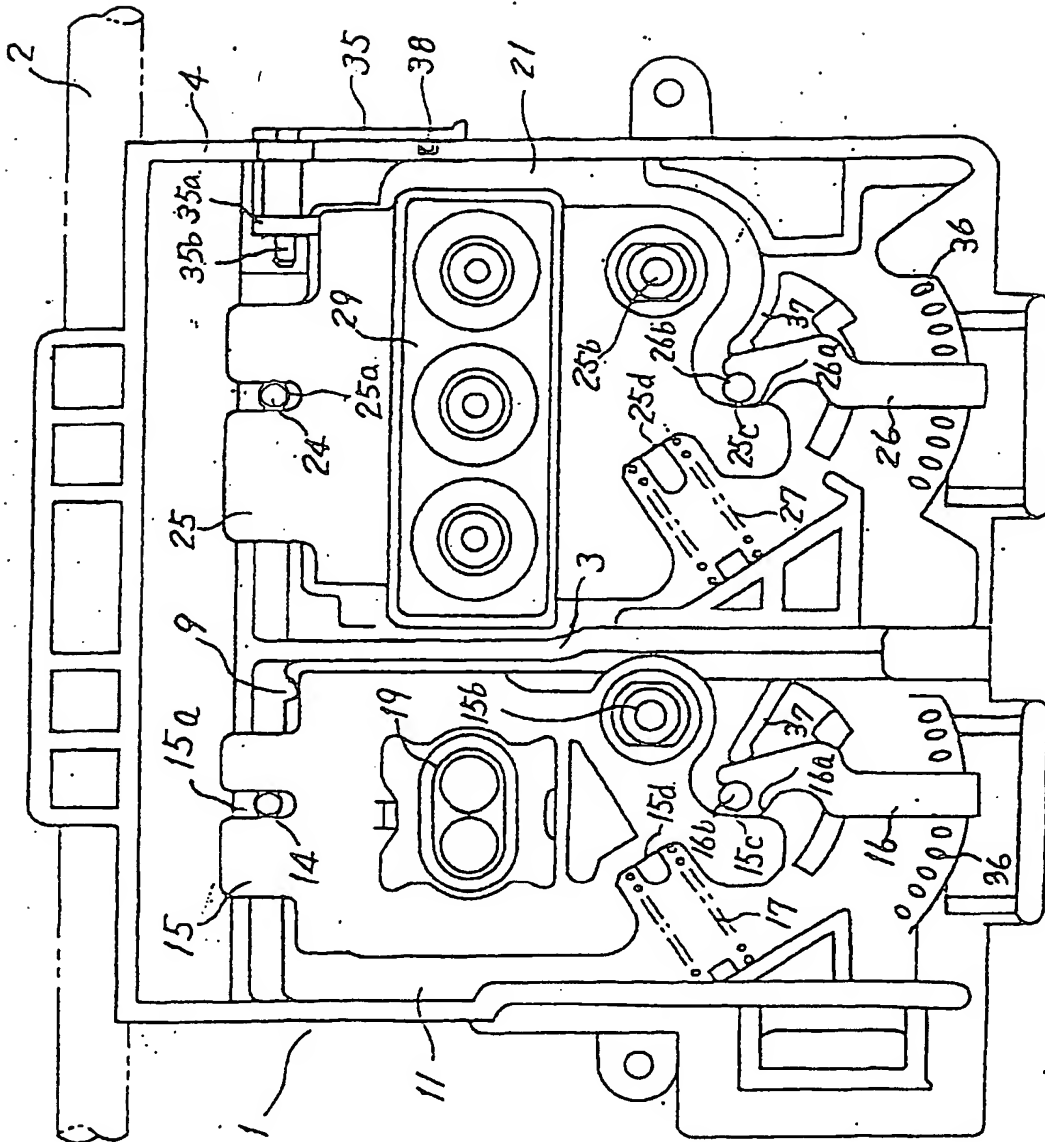
17. The recording head position adjusting mechanism according to claim 11, wherein said nozzle position adjusting member includes a support shaft being disposed parallel to a scanning direction, and a disk essentially attached to said support shaft and having a cam surface which comes in contact with one of said two carrying bodies.

FIGURE 1



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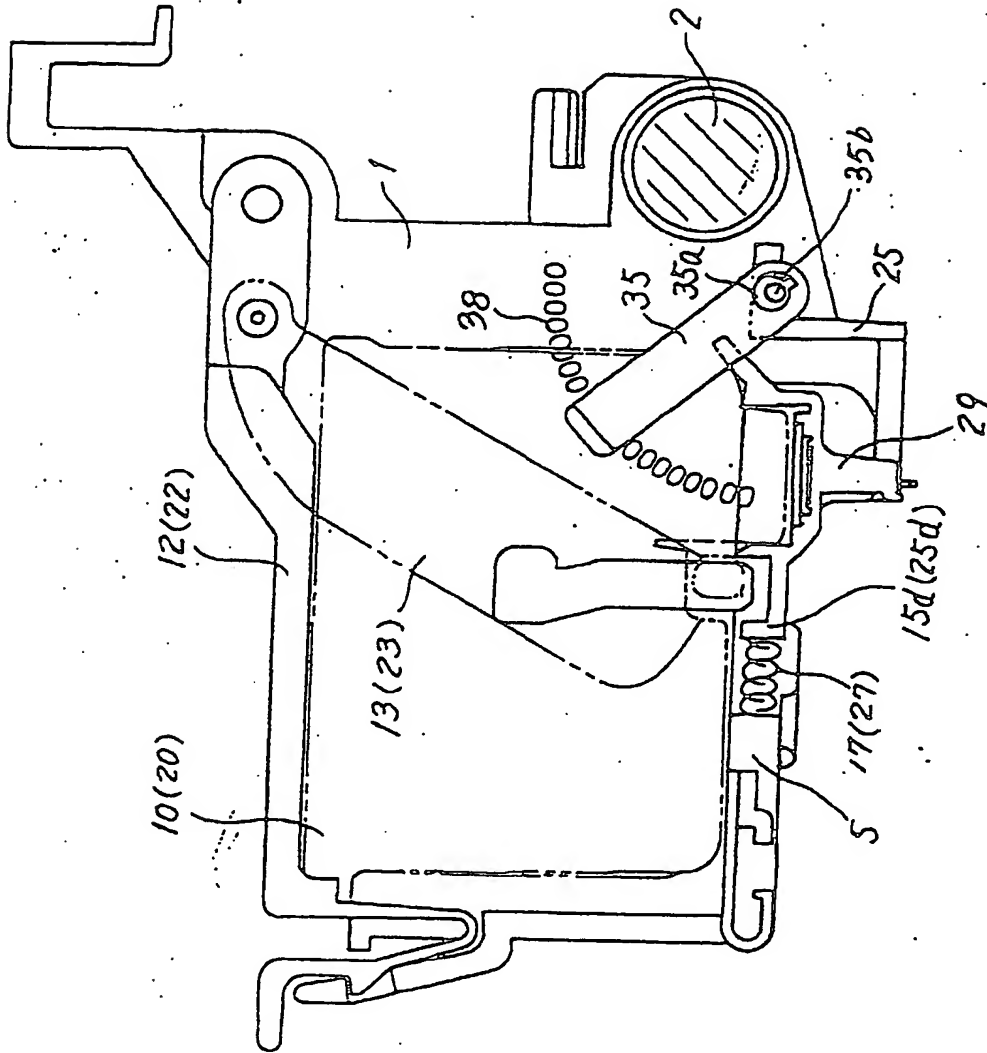
Figure 2



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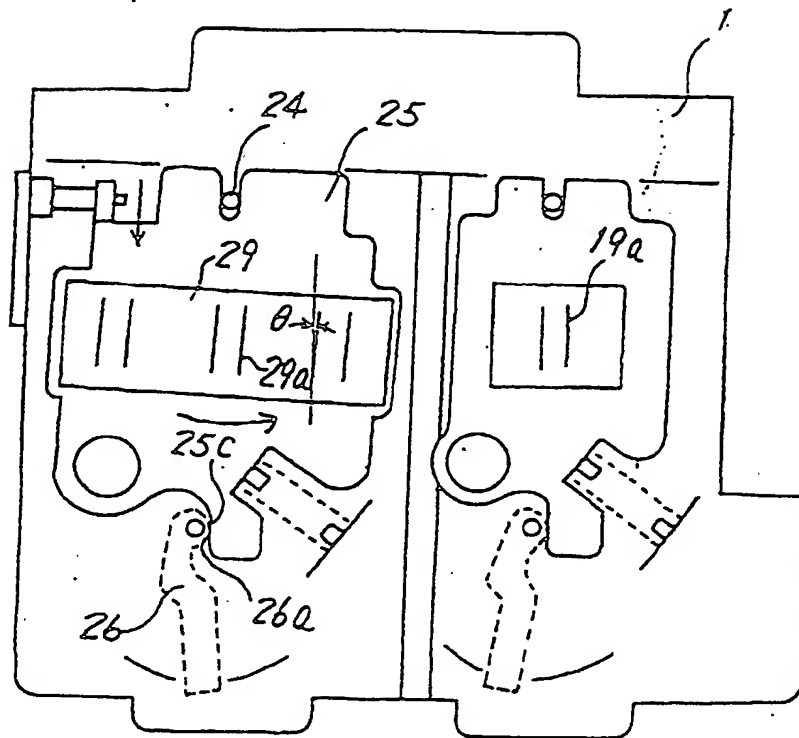


Figure 3



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Figure 4



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(11)

EP 0 824 074 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:

(51) Int. Cl.<sup>6</sup>: B41J 25/34, B41J 25/304.

**B41J 25/308**

(43) Date of publication A2:

18.02.1998 Bulletin 1998/08

**(21) Application number: 97306149.2**

**(22) Date of filing: 13.08.1997**

**(84) Designated Contracting States:**

AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC  
NL PT SE

**(30) Priority: 14.08.1996 JP 23358996**

17.07.1997 JP 20869597

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**(54) Recording head position adjusting mechanism in ink jet recording apparatus**

(57) Not only two plates (15.25) mounted so as to

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sheet forward direction with reference pins (14,24) as

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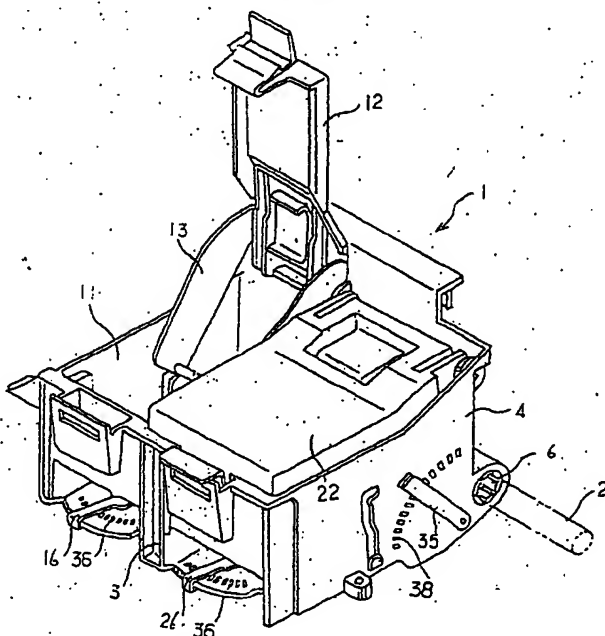
a color recording head can be adjusted in the sheet for-

ward direction by a nozzle position adjusting lever (35)

with a black recording head as a reference, the nozzle

position adjusting lever being disposed on a side wall

(4) of a carriage (1) so as to be operable by turning.





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# EUROPEAN SEARCH REPORT

Application Number  
EP 97 30 6149

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Y		1-4,7,9, 11-14	
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Place of search BERLIN		Date of completion of the search 12 May 1999	Examiner Ducreau, F
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			

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# EUROPEAN SEARCH REPORT

Application Number  
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The present search report has been drawn up for all claims			
Place of search <b>BERLIN</b>		Date of completion of the search <b>12 May 1999</b>	Examiner <b>Ducreau, F</b>
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons Δ : member of the same patent family, corresponding document</p>			

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